CLAIMS

1. A communication subsystem comprising:

a plurality of antennas each adapted to receive an information signal;

a plurality of orthomode transducers, each orthomode transducer coupled to a corresponding one of the plurality of antennas, each orthomode transducer having a first port and a second port, each orthomode transducer being adapted to receive the information signal from the corresponding antenna and to provide at the first port a first component signal having a first polarization and at the second port a second component signal having a second polarization;

a feed network, coupled to the plurality of antennas via the plurality of orthomode transducers, the feed network being adapted to receive the first component signal and the second component signal from each orthomode transducer and to provide a first summed component signal at a first feed port and a second summed component signal at a second feed port; and

a phase correction device coupled to the first feed port and the second feed port and adapted to receive the first summed component signal and the second summed component signal from the feed network;

wherein the phase correction device is adapted to phase match the first summed component signal with the second summed component signal.

2. The communication subsystem as claimed in claim 1, wherein the phase correction device includes a polarization converter unit adapted to reconstruct the information signal, with one of circular and linear polarization, from the first summed component signal and the second summed component signal.

3. The communication subsystem as claimed in claim 2, wherein the polarization correction unit is further adapted to compensate for any polarization skew between the antennas and a source of the information signal.

4. The communication subsystem as claimed in claim 3, wherein the polarization converter unit includes a plurality of attenuators and is configured to provide a value of the attenuation in

a path of each of the first summed component signal and the second summed component signal to compensate for any polarization skew.

5. The communication subsystem as claimed in claim 1, wherein the feed network comprises substantially symmetrical paths so that a path of the first component signal from each orthomode transducer to the first feed port and a path of the second component signal from each orthomode transducer to the second feed port are substantially symmetrical.

6. The communication subsystem as claimed in claim 1, wherein the feed network is a waveguide feed network.

7. The communication subsystem as claimed in claim 6, wherein the first port of each of the orthomode transducers is located on a first side of the orthomode transducer and wherein the second port is located on a second, opposing side of the orthomode transducer.

8. The communication subsystem as claimed in claim 6, further comprising a dielectric insert located within at least one of the first and second feed ports.

9. The communication subsystem as claimed in claim 8, wherein the dielectric insert has a plurality of holes formed therein to control a dielectric constant of the dielectric insert.

10. The communication subsystem as claimed in claim 6, wherein the plurality of orthomode transducers are integrally formed with the feed network and with the plurality of antennas.

11. The communication subsystem as claimed in claim 6, further comprising at least one support bracket integrally formed with the feed network to provide structural rigidity to the feed network.

12. The communication subsystem as claimed in claim 6, wherein the feed network comprises a plurality of fluid drainage holes formed therein.

13. The communication subsystem as claimed in claim 6, wherein the plurality of antennas are horn antennas.

14. The communication subsystem as claimed in claim 13, further comprising a gimbal assembly coupled to the plurality of antennas and adapted to move the plurality of antennas in azimuth and elevation.

15. The communication subsystem as claimed in claim 14, wherein at least one of the horn antennas includes a ring for mounting the horn antenna to the gimbal assembly, and wherein the ring is formed on an outer surface of the horn antenna.

16. The communication subsystem as claimed in claim 15, wherein the ring is formed proximate to an aperture of the horn antenna.

17. The communication subsystem as claimed in claim 16, wherein the ring includes a groove adapted to mate with a post of the gimbal assembly.

18. The communication subsystem as claimed in claim 16, wherein the ring is integrally formed with the horn antenna.

19. The communication subsystem as claimed in claim 13, wherein a height of the horn antenna is less than approximately 12 inches.

20. The communication subsystem as claimed in claim 13, further comprising a radome at least partially enclosing the plurality of horn antennas and the feed network.

21. The communication subsystem as claimed in claim 13, further comprising a plurality dielectric lenses, each one of the plurality of dielectric lenses being coupled to a corresponding horn antenna, that focus the signal to the a feed point of the corresponding horn antenna.

22. The communication subsystem as claimed in claim 21, wherein each dielectric lens is constructed and arranged to fit at least partially inside an aperture of the corresponding horn antenna, such that the dielectric lens is a self centering lens.

23. The communication subsystem as claimed in claim 22, wherein each dielectric lens comprises a slanted edge portion having an angle of the slanted edge portion matching an angle of sides of the horn antenna such that the slanted edge portion fits inside the horn antenna.

24. The communication subsystem as claimed in claim 21, wherein each of the plurality of dielectric lenses is an internal-step Fresnel lens.

25. The communication subsystem as claimed in claim 24, wherein each of the plurality of dielectric lenses has a plano-convex exterior shape.

26. The communication subsystem as claimed in claim 25, wherein each of the plurality of dielectric lenses comprises a single step Fresnel feature having a substantially trapezoidal shape, and wherein a first boundary of the single step Fresnel feature is formed adjacent and substantially parallel to a planar surface of the dielectric lens.

27. The communication subsystem as claimed in claim 26, wherein each of the dielectric lenses further comprises at least one groove formed on at least one of the planar surface of the lens, a convex surface of the lens and at least one boundary of the single step Fresnesl feature.

28. The communication subsystem as claimed in claim 27, wherein the at least one groove comprises a plurality of grooves formed as concentric rings.

29. The communication subsystem as claimed in claim 26, wherein each of the plurality of dielectric lenses comprises at least one groove formed on each of the planar surface of the lens, a convex surface of the lens and at least one boundary of the single step Fresnel feature.

30. The communication subsystem as claimed in claim 21, wherein each of the plurality of dielectric lenses comprises a cross-linked polystyrene material.

31. The communication subsystem as claimed in claim 21, wherein each of the dielectric lenses comprises Rexolite®.

32. The communication subsystem as claimed in claim 21, wherein each of the plurality of dielectric lenses comprises at least one groove formed in a surface of the dielectric lens.

33. The communication subsystem as claimed in claim 32, wherein the at least one groove comprises a plurality of grooves formed as concentric rings.

34. The communication subsystem as claimed in claim 21 wherein each of the dielectric lenses comprises a flange protruding from an outer circumference of the dielectric lens and adapted for mounting the dielectric lens to the horn antenna.

35. The communication subsystem as claimed in claim 1, wherein

the phase correction device includes a feed orthomode transducer, forming part of the feed network, the feed orthomode transducer having a third port and a fourth port, the feed orthomode transducer being substantially identical to each of the plurality of orthomode transducers;

wherein the third port of the feed orthomode transducer is coupled to the second feed port and receives the second summed component signal and the fourth port of the feed orthomode transducer is coupled to the first feed port and receives the first summed component signal, such that a combination of the plurality of orthomode transducers, the feed network and the feed orthomode transducer compensates for any phase imbalance between the first and second component signals.

36. The communication subsystem as claimed in claim 1, wherein the first summed component signal and the second summed signal have a first center frequency; and further comprising:

a first down-converter unit, coupled to the phase correction device, that receives the first summed component signal and the second summed component signal, and that converts the first summed component signal and the second summed component signal to a third signal and a fourth signal, respectively, the third and fourth signals having a second center frequency

that is lower than the first center frequency, the first down-converter unit providing the third and fourth signals at first and second outputs.

37. The communication subsystem as claimed in claim 36, wherein the phase correction device includes a polarization converter unit further adapted to compensate for any polarization skew between the plurality of antennas and a source of the information signal.

38. The communication subsystem as claimed in claim 37, wherein the communication subsystem is mounted on a vehicle and wherein the first and second outputs of the first down-converter unit are fed through a surface of the vehicle and are coupled to additional components located within the vehicle.

39. The communication subsystem as claimed in claim 38, wherein the additional components include a second down-converter unit that receives the third and fourth signals, and that converts the third and fourth signals to a fifth signal and a sixth signal, respectively, the fifth and sixth signals having a third center frequency that is lower than the second center frequency.

40. The communication subsystem as claimed in claim 39, wherein the polarization converter unit provides substantially all phase matching for the communication subsystem

41. A communication system to be located on a vehicle for passengers, the communication system comprising:

an antenna unit including plurality of antennas that receive an information signal having a first center frequency and including a first component signal having a first polarization and a second component signal having a second polarization;

means for compensating for any phase imbalance between the first component signal and the second component signal, and for providing a first signal and a second signal;

a first down-converter unit, coupled to the means for compensating, that receives the first signal and the second signal, and that converts the first signal and the second signal to a third signal and a fourth signal, respectively, the third signal and the fourth signal having a

second center frequency that is lower than the first center frequency, the first down-converter unit providing the third and fourth signals at first and second outputs; and

wherein the antenna unit and the means for compensating are mounted to a gimbal assembly that is adapted to move the combination over a range in elevation and azimuth.

42. An internal-step Fresnel dielectric lens comprising:

a first, exterior surface having at least one exterior groove formed therein;

a second, opposing surface having at least one groove formed therein; and

a single step Fresnel feature formed within an interior of the dielectric lens, the single step Fresnel feature having a first boundary adjacent the second surface and a second, opposing boundary;

wherein the second boundary has at least one groove formed therein.

43. The internal-step Fresnel dielectric lens as claimed in claim 38, wherein the lens comprises a cross-linked polymer polystyrene material.

44. The internal-step Fresnel dielectric lens as claimed in claim 38, wherein the lens comprises Rexolite®.

45. The internal-step Fresnel dielectric lens as claimed in claim 38, wherein the first surface of the dielectric lens is convex in shape and the second surface of the lens is planar.

46. The internal-step Fresnel dielectric lens as claimed in claim 41, wherein the single step Fresnel feature is trapezoidal in shape with the first boundary being substantially parallel to the second surface of the lens.

47. The internal-step Fresnel dielectric lens as claimed in claim 38, wherein the at least one groove formed on any of the first surface of the lens, the second surface of the lens and the second boundary of the single step Fresnel feature comprises a plurality of grooves formed as concentric rings.

48. An antenna assembly comprising:

a first horn antenna adapted to receive a signal from a source;

a second horn antenna, substantially identical to the first antenna, and adapted to receive the signal;

a first dielectric lens coupled to the first horn antenna to focus the signal to a feed point of the first horn antenna, the first dielectric lens having at least one groove formed in a surface thereof;

a second dielectric lens coupled to the second horn antenna to focus the signal to a feed point of the second horn antenna, the second dielectric lens having at least one groove formed in a surface thereof;

a waveguide feed network coupled to the feed points of the first and second horn antennas and including a first feed port and a second feed port, the waveguide feed network being constructed to receive the signal from the horn antennas and to provide a first component signal having a first polarization at the first feed port and a second component signal having a second polarization at the second feed port; and

a polarization converter unit coupled to the first feed port and the second feed port that is configured to compensate for any polarization skew between the antennas and the source.

49. The antenna assembly as claimed in claim 44, wherein the first and second dielectric lenses are internal-step Fresnel lenses comprising a single step Fresnel feature.

50. The antenna assembly as claimed in claim 44, wherein the dielectric lenses have a plano-convex exterior shape.

51. The antenna assembly as claimed in claim 44, wherein the at least one groove comprises a plurality of grooves formed as concentric rings.

52. The antenna array as claimed in claim 47, wherein the plurality of grooves are formed on a convex surface of each of the dielectric lenses.

53. An antenna assembly comprising:

an antenna adapted to receive an information signal;

an orthomode transducer coupled to a feed point of the antenna and having a first port and a second port, the orthomode transducer being constructed to receive the information signal from the antenna and to split the information signal to provide, at the first port, a first component signal and, at the second port, a second component signal, the second component signal being orthogonally polarized to the first component signal; and

a polarization converter unit coupled to the first and second ports of the orthomode transducer and adapted to receive the first and second component signals;

wherein the polarization converter unit is constructed to compensate for polarization skew between the antenna and a source of the information signal and to phase match the first component signal to the second component signal; and

wherein the polarization converter unit is further adapted to reconstruct the information signal, with any polarization, from the first and second component signals.

54. The antenna assembly as claimed in claim 49, wherein the antenna is a horn antenna.